Richardson Hill Road Landfill: 2012 Contaminant Trackdown Study Field Investigation Report

by

Corbin J. Gosier and Eric A. Paul

Bureau of Habitat
Division of Fish, Wildlife and Marine Resources
New York State Department of Environmental Conservation
Albany, New York

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1 Introduction/Background

The Richardson Hill Road Landfill (RHRL) is an inactive hazardous waste site located in the towns of Masonville and Sidney in Delaware County, New York. The site was added to the National Priorities List (NPL) on July 1, 1987. The larger Sidney Landfill lies immediately to the northeast of the RHRL and is also on the NPL. RHRL sits adjacent to South Pond, which is part of a larger wetland positioned at the origin of Herrick Hollow Creek (Figure 2). Herrick Hollow Creek (HHC) is a first order, headwater stream within the Delaware River drainage basin that forms from surface water runoff and groundwater discharge. The RHRL contributes both surface water and groundwater to South Pond and the HHC stream channel and was the source of contamination to the stream prior to remediation. During its operation, the landfill received primarily municipal waste, but also contained a "pit" that received waste oils containing PCBs (Barton & Loguidice 2009). South Pond was first excavated in 1993 following a fish kill that was attributed to contaminants seeping from the oil disposal pit. Prior to excavation, PCB concentrations in South Pond sediments were as high as 1,300 mg/kg. A remedial investigation later revealed PCBs downstream of South Pond in HHC sediments as high as 180 mg/kg, and in floodplain soils at 24 mg/kg (USEPA 2012).

The Record of Decision (ROD) was issued by EPA in September 1997. The selected remedy included "excavation and/or dredging of sediments exceeding 1 mg/kg PCB from South Pond and all areas downstream for approximately 2,400 feet" (USEPA 1997). Remediation of the landfill and the adjacent stream corridor including South Pond began in 2003. The landfill closure was finished in 2006 and included a landfill cap, groundwater extraction trench, and a groundwater treatment plant that treats extracted groundwater before discharging to South Pond (Parsons, August 2007). Remediation of the adjacent HHC corridor involved the removal of PCB-contaminated surface sediments from South Pond, the stream channel, and its associated wetlands that included a series of beaver ponds. Restoration of the stream corridor was completed in 2004, however, the remnants of Hurricane Ivan in September 2004 and another storm in April 2005 damaged the newly restored stream corridor and prompted a second attempt at restoration. The final restoration of the stream corridor was completed in 2008 (Barton & Loguidice 2009).

PCB concentrations in fish collected from HHC remained elevated following remediation efforts at the RHRL. All of the fish collected in 2008 had detectable levels of PCB, ranging from 0.11 to 8.2 ppm. These concentrations were similar to those from pre-remediation sampling efforts, indicating potentially continuing PCB contributions from the landfill, and suggesting that lifting of the current health advisory (NYSDOH 2012) for the consumption of fish was unlikely. The final monitoring event occurred in 2011 and fish tissue PCB concentrations ranged from 0.03 to 0.14 ppm, much lower overall than in 2008.

2 Objective

The objective of this investigation was to provide a comprehensive assessment of the presence and magnitude of residual PCBs in sediment, surface water, and biota. To accomplish this objective, a contaminant trackdown study using PISCES (Passive In-Situ Chemical Extraction

Samplers) was conducted alongside an expanded fish tissue and sediment sampling program. Sampling took place during September and October 2012. This report presents the findings of the 2012 investigation.

3 Previous Investigations

NYSDEC conducted a PCB track-down investigation of the upper West Branch Delaware River Watershed in 2005 (Preddice 2006). The study was intended to determine the cause of elevated PCB concentrations that had been detected in river otter blood plasma samples. In that investigation, only small amounts of PCBs (up to 45.6 ng) accumulated in PISCES samplers placed throughout the watershed. Although PISCES samplers had not been deployed within HHC, the 2006 report concluded that the low PCB levels throughout the watershed suggested a successful cleanup at the RHRL, but that post-remedial monitoring should be conducted within HHC and upper Trout Creek.

Post-remedial monitoring for the RHRL that was conducted in 2008 showed elevated concentrations of PCBs in fish tissues (up to 8.2 mg/kg), indicating that biota in the vicinity of RHRL were still being exposed to elevated levels of PCBs. USEPA conducted an Optimization Evaluation of the RHRL and the nearby Sidney Landfill (report dated April 4, 2012). That report acknowledged the elevated levels of PCBs found in 2008 fish samples as well as the continued presence of PCBs in South Pond sediments, although all were below the 1 mg/kg sediment cleanup number. The Optimization Evaluation Report speculated that the source of PCBs to HHC was residual contamination down gradient of the groundwater collection trench and that "[i]f PCBs from up gradient of the trench are captured, the flux of PCBs to South Pond should decrease slowly over time." Based on comments from NYSDEC, the Optimization Evaluation Report provided recommendations for evaluating PCB contamination in South Pond which included recommendations for a potential PISCES study. Such an evaluation, however, was contingent on the results of the 2011 fish tissue data which were unavailable at that time. The data from the 2011 monitoring event are now available and reported fish tissue PCB concentrations within HHC were much lower (< 0.2 mg/kg) in 2011 than in 2008, indicating that contaminant conditions have improved.

4 Methods

4.1 PISCES Sampling

To aid in identifying possible sources of PCBs to Herrick Hollow Creek, Hassett-style PISCES samplers were deployed in and around Herrick Hollow Creek (nine locations) and also Trout Creek (two locations) on September 25, 2012 (Table 1; Figure 3). PISCES sampling was conducted in accordance with the standard operating procedures (SOP) described in *Contaminant Track-down With PISCES, Standard Operating Procedures* (Preddice 2007) with two exceptions that will be discussed later in this section. At each sample location, two (2) PISCES samplers were suspended in the water column, usually attached to either side of an anchor block with polypropylene rope. This technique was modified for locations 3 and 4 to avoid sampler contact with the "fluffy" sediment layer within South Pond. At location 3, two anchor blocks were stacked and the samplers were affixed to the top block. At location 4,

samplers were tied to the existing staff gauge and suspended in the water column. Prior to deployment, each sampler was filled with 180 mL of 2,2,4 trimethylpentane (TMP) and spiked with 500 ng of trans-chlordane. Relevant data were recorded at the time of deployment and included sample coordinates, water temperature and conductivity. Samplers were retrieved after 15 days on October 10, 2012 and transported to the NYS DEC laboratory at the Hale Creek Field Station in Gloversville, NY the same day.

As mentioned earlier, there were two notable deviations from the SOP. First, TMP was used in place of hexane. TMP is described as an acceptable solvent in the SOP, however, due to its higher molecular weight, it is recommended for bag-style samplers where solvent leakage is a greater concern. Secondly, a field blank was not constructed or sent to the laboratory for analysis.

4.2 Sediment Sampling

Sediment sampling took place on October 11th, 2012 starting with the farthest location (SED 10) and working toward the site, generally from downstream toward upstream. Samples were collected using one of three methods depending on sediment type. Soft, fine-grained sediments (SED-1, 3, 4, 5) were collected using a 6" petite ponar. A stainless steel scoop was used where course grained sediments were encountered (SED 10, 11, 12) and a disposable plastic scoop was used at SED 2 to penetrate vegetation and collect the sample. At each location, sediment samples were transferred to a stainless steel bucket. Excess water was decanted and a new disposable scoop was used to stir and transfer sediments to 8-ounce glass laboratory sample jars. Each jar was labeled at the time of collection and placed back into the cooler. All non-disposable equipment was rinsed off, brushed clean, and re-rinsed between sample sites. After sediment sampling was completed, the cooler was taken to Test America in Albany, NY on the same day. Test America then shipped the sediment samples to their Buffalo, NY laboratory for PCB analysis.

On the date of collection, field staff noted that locations SED 6, 7, and 8 were in fast flowing water and had gravel/cobble streambed material. These sites were omitted from sampling since the detection of PCBs would be unlikely given the lack of fine grained sediments. Further, these sample locations are linearly configured with sediment sampling locations a short distance upstream and downstream. Omitting these three sample locations would have little effect on the conclusions of this study.

4.3 Fish Tissue Sampling

Fish sampling was conducted after PISCES samplers were retrieved. Fish were collected from Trout Creek and Herrick Hollow Creek using a backpack electrofishing unit. Herrick Hollow Creek was sampled from downstream toward upstream while ensuring that sampled stretches did not overlap. South Pond was sampled using an eight-meter nylon minnow seine. In total, eight (8) fish sampling locations were selected (Figure 5). Six (6) of the fish sampling locations were intended to re-sample locations from the two previous sampling events conducted in 2008 and 2011 by Amphenol (a potentially responsible party) and USEPA respectively. Since HHC is a first order stream originating along the divide of two adjacent drainage basins, there was no upstream location that could be sampled within Herrick Hollow Creek. Instead, an upstream

Trout Creek location (TC 1) was added to serve as the "upstream" reference to both Trout Creek and HHC. This sample location is approximately 1600 meters above the confluence with HHC. The first downstream road crossing was selected as the other Trout Creek location (TC 2) which was approximately 1250 meters below the confluence of Trout and Herrick Hollow creeks. This location was intended to determine whether continuing PCB contributions (if any) from the RHRL are causing elevated concentrations in Trout Creek as well.

Target species were selected based on anticipated availability and to be consistent with those collected during previous sampling events which included pumpkinseed (*Lepomis gibbosus*) from South Pond, creek chub (*Semotilus atromaculatus*) from each sample location, and brook trout (*Salvelinus frontinalis*) from HHC downstream locations 5 and 6. At each location five (5) forage fish samples and five (5) samples from the highest trophic level available were targeted for a total of eighty (80) samples. Ultimately, 79 samples were submitted for analysis which included all of the species listed above as well as brown trout (*Salmo trutta*), blacknose dace (*Rhinichthys atratulus*), and a single bluegill (*Lepomis macrochirus*) collected at the upstream Trout Creek location for comparison with South Pond pumpkinseed. All of the samples were handled in accordance with *Procedures for Collection and Preparation of Aquatic Biota for Contaminant Analysis* (NYSDEC 2002). Creek chub, pumpkinseed and small brook and brown trout samples were prepared for whole body analysis. Medium-sized brook trout and brown trout (150 to 200 mm in length) were prepared for human health analysis by modified standard fillet where only the head and viscera are removed. Trout that were greater than 200 mm in length were prepared as DEC standard fillets. Samples were composited only when necessary to achieve the minimum required sample mass of 10 grams (Tables 5A - 5D). Composites were formed using a single species and grouped according to size. Fish were kept alive in plastic tubs until processing in the field, which occurred the same day they were collected. During processing, length and weight measurements were taken on individual fish and each sample was packaged separately and placed in coolers on dry ice. Fish collections were completed over three days (October 10-12) and all fish tissue samples were then transported to the NYS DEC laboratory at the Hale Creek Field Station for preparation and analysis.

5 Results

5.1 PISCES

Aroclor 1242 was detected in solvent analyzed from every PISCES sampler that was deployed. The amount of PCB uptake ranged from 54.5 to 796 ng. All of the samples were deemed usable at the time of retrieval as there was no membrane fouling or loss of solvent during the 15-day period that the samplers were deployed. As a result, every sample location yielded two results since samplers were paired at each location. Similar amounts of PCBs were sequestered in each sampler pair while rather large differences were noted among sample locations, further indicating quality results.

The lowest amounts of PCBs were from samplers deployed at upstream Trout Creek reference location PISCES 10 (mean 63.5 ng). This location was also statistically lowest based on the 95% confidence interval. The second lowest values came from samplers deployed at PISCES 11 (mean 84.7 ng) in Trout Creek, downstream of the confluence with HHC. The lowest PCB values in the vicinity of the RHRL were from sample pair PISCES 1 deployed at the water

treatment plant discharge (mean 122 ng). The highest values within HHC were from PISCES 5 deployed just downstream of South Pond (mean 203 ng). The highest values overall (mean 624 ng) were from samplers deployed at PISCES 6, located within the storm water basin/pond immediately southeast of the landfill. These results are also statistically significant based on the 95% confidence interval. PISCES data are presented in Table 2 and on Figure 3.

5.2 Sediment

PCBs were detected in sediment samples collected at SED 2, 3, 4, and 5 and ranged in concentration from 0.37 – 2.6 mg/kg. All other sediment samples were non-detect for PCBs. Only Aroclor 1248 was detected in sediments. SED 1, which was collected from a wetland drainage seep located above the northwest corner of South Pond, contained no measurable PCBs. This location was selected to represent an area down gradient from the treatment plant discharge and immediately up gradient of South Pond. SED 2 was collected from a wetland drainage seep above the northeast corner of South Pond and contained the highest concentration of PCBs of all sediment samples at 2.6 mg/kg. The two samples within South Pond had the next highest PCB concentrations with SED 3 and the SED 3 duplicate at 0.5 and 1.0 mg/kg respectively and SED 4 at 0.38 mg/kg. The margin of PCB concentration between sample SED 3 and its duplicate was most likely due to incomplete mixing prior to transferring sediments to sample jars. Sample SED 5 was immediately downstream of South Pond and contained 0.37 mg/kg PCBs, the lowest of all detected samples. PCBs were not detected in the remaining downstream sediment sample location within HHC (SED 9), nor were they detected in either Trout Creek sample location (SED 10 and 11). Sediment data are presented in Table 3 and on Figure 4.

5.3 Fish tissue

Of the 80 targeted fish tissue samples (10 samples x 8 locations), 79 samples were submitted for analysis. Fewer than 10 samples were collected at HHC 2 and 3 due to limited numbers of secondary-target fish species at those locations. Additional fish were collected at TC 1 and 2 in an attempt to ensure similar secondary-target species were collected in both Trout Creek and Herrick Hollow Creek. Creek chub (*Semotilus atromaculatus*) became the primary-target species as they were the most consistently encountered species and were collected from all 8 sample locations (5 samples per location). There was no other single species encountered at every location so the remaining 5 samples per location were selected based on presence, abundance, and trophic level of the other species encountered. Brook trout (*Salvelinus frontinalis*) and brown trout (*Salmo trutta*) were selected for analysis where present (HHC 6, TC 1 and 2) because they occupy a higher trophic level and because larger specimens could be filleted in order to provide information relating to human consumption risk. Blacknose dace (*Rhinichthys atratulus*) were selected as the second species within the HHC project reach (stream section) because they were abundant at HHC 4 and 5 and also present at HHC 2 and 3. Five pumpkinseed (*Lepomis gibbosus*) samples were collected from South Pond, two from HHC 3, and a single bluegill (*Lepomis macrochirus*) collected at the upstream Trout Creek location was analyzed for comparison with South Pond pumpkinseed.

Total PCB concentrations in fish tissue ranged from non-detect to 0.771 mg/kg (ppm) on a wet weight basis. Aroclor 1242 and Aroclor 1254/60 were detected in tissue samples and contributed to total PCB concentrations. In total, six samples were non-detect for PCBs and all of those

samples were collected from the upstream reference location in Trout Creek (TC 1). The next four lowest PCB detections (0.011 – 0.013 ppm) also came from TC 1. The highest total PCB concentration (0.771 ppm) was from a blacknose dace composite collected at HHC 5. The next three highest PCB concentrations (0.616 - 0.716 ppm) were from creek chub and pumpkinseed collected from South Pond. Fish tissue data are summarized in Table 4 and on Figures 5 through 9 and presented in Tables 5A through 5D.

Fish tissue PCB concentrations were also evaluated relative to each sample's lipid content. These "lipid-based" PCB concentrations are useful when comparing between sample locations and among species where lipid content may vary. Lipid-based concentrations are less applicable when comparing PCB data to risk-based thresholds (e.g., NYS fish flesh criteria) as these thresholds are generally not lipid based. Similar to the wet-weight concentrations discussed above, lipid based PCB concentrations were generally lowest in fish collected from TC 1 (ND – 12.9 ppm) and highest in fish collected from South Pond/HHC 1 (16.4 – 59.2 ppm).

In addition to PCBs, fish tissue samples were analyzed for a number of other contaminants including mercury and several common pesticides. Among these, only mercury was detected in fish throughout the study area. Mercury concentrations in fish ranged from 0.04 – 0.34 mg/kg. Average mercury concentrations were variable among species, but did not vary significantly among sample locations. These results suggest that the RHRL is not influencing mercury concentrations in fish.

6 Discussion

6.1 PISCES

Prior to this investigation, little was known about water column PCBs except that concentrations had fallen below the laboratory detection limit of 0.05 µg/L. This is because previous rounds of monitoring have focused on routine water sampling and analysis using EPA Method 8082. PISCES samplers, on the other hand, concentrate water column PCBs over the period of time that they are deployed, allowing the detection of PCBs which are present in water below the detection limits of Method 8082. In addition, PISCES samplers are deployed at a fixed point and only extract PCBs passing by that fixed point. Therefore, the relative amount of PCB that accumulates at each sample location can be used to aid in locating sources of contamination.

PISCES results demonstrate that PCBs are still present in the water column of South Pond, HHC, and to a lesser extent Trout Creek. The two Trout Creek locations had less PCB than any of the HHC locations. Greater amounts of PCBs were collected in Trout Creek below its confluence with HHC than above indicating that water flowing from HHC is contributing PCBs to Trout Creek, albeit a very small amount. The larger flow of Trout Creek appears to be diluting the dissolved phase PCBs coming from HHC.

PISCES data were also evaluated to determine whether a point source to South Pond or HHC exists. No point sources to South Pond were identified during this PISCES investigation; however there is some evidence of a point source to HHC just to the south of the pond. The two samplers deployed at PISCES 6 concentrated significantly more PCB than any other location (Table 2). This location was within the storm water basin/pond immediately southeast of the

landfill. Further investigation of this sediment basin and its water sources would be needed to determine the cause of elevated PCBs and whether a problem with the landfill cap or its surface drainage exists.

Greater amounts of PCBs concentrated in the PISCES samplers during this investigation than in the 2006 investigation conducted in areas downstream, but within the same watershed. This indicates that RHRL site continues to contribute low-level PCBs (relative to pre-remediation levels) to HHC. This is consistent with the findings discussed above but it also demonstrates that PCBs from HHC are quickly diluted upon entering Trout Creek, and continue to be diluted further downstream as more "clean" water enters Trout Creek from other tributaries. The 2006 report concluded that RHRL "no longer is a major source" of PCBs to the watershed, a conclusion that is supported by the results of this investigation as well. The 2006 report also states that major reductions in PCBs throughout the watershed suggest "cleanup efforts at the landfill were successful". However, watershed-scale "success" should not have been interpreted to imply overall remedial success, especially at a more local scale (i.e., within HHC). Clearly though, the remediation of RHRL and HHC have contributed to significant improvements to the water quality within HHC.

6.2 Sediment

PCB concentrations in sediment generally decreased with increased distance downstream from South Pond and there were no PCB detections in Trout Creek or HHC downstream of SED 5. This trend cannot be attributed solely to proximity to the landfill since downstream sample locations, as well as those collected from Trout Creek were in faster flowing water with noticeably larger sediment grain size (sand, gravel) which are less likely to sequester PCBs. Where PCBs were detected close to the site they were found in sediments with much finer grain size (clay, silt) with vegetation or decomposing organic matter. The higher organic content indicates a higher likelihood that PCBs would be sequestered, and therefore detected.

SED 2 had the highest concentration indicating a potential source of PCBs to South Pond. Elevated PCBs in this area comes as a surprise as this wetland seep drains into the northeast corner of South Pond, opposite the landfill. Interestingly, PCBs were not detected in sediments from SED 1, collected from the wetland seep that is closer to the landfill and only about 150 feet west of SED 2. The origin of SED 2 PCBs is uncertain at this time but the location suggests a few possibilities. Based on aerial images, the SED 2 wetland seep appears to carry runoff originating from the central portion and eastern edge of the wetland. The elevated PCB result from SED 2 could therefore be the result of unremediated sediments in the vicinity of SED 2 or could be indicative of another source to the northeast. Further investigation would be needed to track down the origin of elevated PCBs in this area. Sediment samples were not collected from the eastern/non-landfill side of South Pond, so our understanding of the presence and magnitude of PCBs immediately down gradient from the SED 2 area is limited at this time.

Two sediment samples (SED 3 and SED 4) were collected from the western/landfill side of South Pond. SED 3 had the higher PCB concentration of the two. When comparing sediment data to PISCES data, collocated PISCES 3 also had the highest amount of PCB in South Pond. It does not appear that surface drainage from the landfill was responsible for higher sediment PCBs at SED 3 as the sediment basin that drains into the northwest corner of South Pond was evaluated

via PISCES and did not contain more PCB than other nearby locations. These results indicate a condition may exist that is causing locally elevated PCBs in the vicinity of SED 2, but further investigation would be needed to pinpoint the cause.

6.3 Fish Tissue

Creek chub was the only species collected at all 8 locations (5 samples per location). When comparing creek chub tissue concentrations (both wet weight and lipid-based) between sample locations, fish from the upstream reference location (TC 1) had significantly lower PCB concentrations than any other location. This was the only location where a portion of the fish sampled (60% of creek chub and half of all fish captured) did not have detectable levels of PCBs, and when PCBs were detected they were among the lowest concentrations at any location. At all other sites, PCBs were found above detection limits in all fish samples. The downstream Trout Creek location (TC 2) below its confluence with HHC had higher PCB concentrations in creek chub averaging 0.118 ppm. South Pond (HHC 1) had the highest PCB concentration in a creek chub sample (0.716 ppm) as well as the highest mean PCB tissue concentration in creek chub (0.414 ppm). Mean PCB concentrations in creek chub at the remaining Herrick Hollow Creek locations ranged from 0.131 to 0.281 ppm. The trend in PCB tissue concentrations moving downstream (i.e., away from the landfill) was not uniform. Instead, PCB concentrations in Creek Chub decreased through HHC 3 and then increased between HHC 3 and HHC 6. These findings are also supported by lipid based PCB concentrations (Figures 6 and 9), which eliminated some of the variability within sample locations due to variation in lipid content.

PCB concentrations among the other fish species that were analyzed follow the same patterns described above, although the presence of these species was more restricted by location. For example, brook and brown trout were present only at TC 1, 2, and HHC 6. As with creek chub, trout species had the lowest average PCB concentration at the upstream reference location (TC 1) where 3 of 6 samples did not have detectable levels. When compared to the upstream reference site (TC 1), TC 2 had slightly higher concentrations overall (mean = 0.118 ppm), even though a single trout collected from the reference location was larger than the trout collected from TC2 by more than 13 cm. Herrick Hollow Creek (HHC 6) had the highest PCB concentration in a single trout (0.612 ppm) as well as the highest mean concentration (0.493 ppm). Where they were present, blacknose dace exhibited significantly higher mean PCB concentrations than creek chub on a wet weight basis, however lipid based concentrations were not significantly different among these species indicating that this finding is due entirely to the higher lipid content of blacknose dace.

PCB trends were similar along Herrick Hollow Creek for all species, with a decreasing trend moving downstream from South Pond to HHC 3 and then an increase through HHC 6. These trends are most evident in the lipid based concentrations. The noted trends could be the result of habitat differences among locations that influence prey availability and therefore PCB uptake. More likely, they could be indicative of a PCB source somewhere downgradient of South Pond. The PISCES results seem to support the latter conclusion based on significantly higher amounts in the samplers deployed in the southern sediment basin/pond. A final consideration is that removal of contaminated sediment extended approximately 2,400 feet downstream from South Pond and ended between HHC 5 and 6. It is possible that the unremediated downstream section of HHC is contributing to the increases in fish tissue concentrations. The 2007 ROD stated,

"The need for remediation in areas further downstream will be evaluated based on an assessment of sediment concentration and biological receptors (i.e., fish tissue concentrations over the 5 year time period subsequent to the completion of upstream remediation activities)."

7 Summary of Findings

- Concentrations of PCB in fish have declined significantly from pre-remediation levels as well as 2008 post-remediation levels.
- Concentrations of PCB in fish from South Pond and Herrick Hollow Creek were found to be somewhat higher in this investigation (0.06-0.77 ppm) than fish collected during the previous round in 2011 (0.03-0.14 ppm).
- South Pond and Herrick Hollow Creek, in the vicinity of the Richardson Hill Road Landfill have not achieved background/reference location PCB levels in any of the sampled media (water column, sediment, and fish tissue).
- PCBs were found only in soft, fine grained sediments associated with the wetland, South Pond, and upper Herrick Hollow Creek. PCBs were not found in course grained sediments associated with lower Herrick Hollow Creek or Trout Creek.
- PCBs are present in fish collected from downstream Herrick Hollow Creek (HHC 3 – 6) and Trout Creek below its confluence with Herrick Hollow Creek where sediments were non-detect but PISCES accumulated PCBs.
- The highest concentration of PCBs in sediments (2.6 ppm) was from SED 2, the eastern wetland seep entering South Pond.
- The greatest amount of water column PCBs (mean 624 ng) accumulated in samplers deployed at PISCES 6, the southern sediment basin/pond.

8 Conclusions

The selected remedy for the RHRL site included removal of sediments exceeding 1 ppm total PCBs (USEPA 1997). These sediments were successfully removed from the project area, however sediments exceeding 1 ppm are still present in an upgradient wetland seep. Overall fish tissue concentrations have declined considerably in the years following remediation, however residual PCBs in the vicinity of the RHRL continue to accumulate in fish.

South Pond and Herrick Hollow Creek, in the vicinity of the Richardson Hill Road Landfill had significantly greater PCB concentrations in water column, sediments, and biota samples than the reference location (TC 1). While remediation has improved conditions by reducing PCB concentrations in these environmental media, PCB levels in HHC fish remain above the New York State ecological fish flesh criteria of 0.11 ppm (NYSDEC 1987). The mean PCB concentration in creek chub collected in South Pond was 0.41 ppm (0.72 max) and the mean brook trout sample collected in HHC was 0.49 ppm (0.61 max).

Our data also demonstrated that PCBs are entering Trout Creek from Herrick Hollow Creek, although fish tissue concentrations and PISCES results were both rather low due to mixing with the relatively clean water from upstream Trout Creek. The mean PCB concentration in creek

chub collected at TC 2 was 0.12 ppm (0.20 max) and the mean concentration in trout was also 0.12 ppm (0.18 max). While these concentrations are not of great concern based on the NYS criteria, they are a significant increase from the upstream "clean" condition in Trout Creek (TC 1) where the mean PCB concentration in creek chub was at or below the detection limit.

9 Recommendations

Based on the above findings, there are three areas that should be investigated further. First, the source of PCBs found in sediments of the eastern wetland seep (SED 2) should be investigated. A more focused investigation of this area should include sediment samples collected from the area up-gradient from SED 2 as well as the northeastern quadrant of South Pond. Next, the source of elevated water column PCBs from the southern sediment basin/pond (PISCES 6) should be investigated. This would include focused sediment (and possibly fish tissue) sampling within the southern sediment basin/pond and also a desktop evaluation of the landfill surface drainage to look for potential causes of elevated PCBs in the southern drainage. Third, it is unclear why fish tissue PCB concentrations increase (on a lipid basis) moving downstream between HHC 3 and HHC 6 and the cause of the apparent increase should be investigated. This could include the collection of additional sediment samples as well as an evaluation of surface water drainage between the landfill and these downstream locations.

Lastly, these findings should be considered in the future when selecting sediment removal alternatives at PCB-contaminated sites. Remediated sediments within South Pond and HHC remained at or below the 1 ppm cleanup concentration, but PCB concentrations in fish analyzed during this investigation were as high as 0.771 ppm which exceeds the Department's ecological fish flesh criteria of 0.11 ppm (NYSDEC1987). This demonstrates that while removing a substantial amount of PCB-contaminated sediment has substantially reduced PCB concentrations in fish, residual concentrations in fish and wildlife mirror residual contamination in sediments.

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Table 1. PISCES Sample Locations

Sampling Site	Location Description
PISCES #1	Groundwater Treatment Plant (GWTP) outfall
PISCES #2	Sediment Trap 1
PISCES #3	South Pond (NW quadrant)
PISCES #4	South Pond (SW quadrant)
PISCES #5	Upstream of HHC logging road crossing
PISCES #6	Sediment Trap 2
PISCES #7	Beaver Pond
PISCES #8	Downstream reach (project side)
PISCES #9	Downstream reach (just beyond RHR culvert)
PISCES #10	Trout Creek upstream of confluence with HHC (at intersection of Pine Swamp Road and Teed Road)
PISCES #11	Trout Creek downstream of confluence with HHC (just upstream of the Peggy Switch Road overpass)

Table 2. PISCES Data Summary

Location ID	Laboratory Sample No.	Solvent Recovered (mL)	Spike Material Recovered (%)	AR 1242					
				Amount (ng)	Mean (x̄)	Standard Dev	Confidence (alpha = 0.05)	Lower	Upper
PISCES 1	31	180	107	150	122.3	39.2	54.3	68.0	176.6
	32	180	113	94.6					
PISCES 2	33	180	116	138	135.5	3.5	4.9	130.6	140.4
	34	180	123	133					
PISCES 3	35	176	103	166	176.5	14.8	20.6	155.9	197.1
	36	186	119	187					
PISCES 4	37	203	110	155	142.5	17.7	24.5	118.0	167.0
	38	182	115	130					
PISCES 5	39	180	114	228	202.5	36.1	50.0	152.5	252.5
	40	180	119	177					
PISCES 6	41	170	120	452	624	243.2	337.1	286.9	961.1
	42	180	105	796					
PISCES 7	43	180	98.4	165	172	9.9	13.7	158.3	185.7
	44	180	112	179					
PISCES 8	45	180	112	213	189	33.9	47.0	142.0	236.0
	46	180	111	165					
PISCES 9	47	168	96.2	195	156	55.2	76.4	79.6	232.4
	48	160	92.2	117					
PISCES 10	49	182	102	72.5	63.5	12.7	17.6	45.9	81.1
	50	180	115	54.5					
PISCES 11	51	180	103	88	84.65	4.7	6.6	78.1	91.2
	52	180	91.9	81.3					

Table 3. Summary of PCB Concentrations in Sediments

	SED 1	SED 2	SED 3	Duplicate SED 3	SED 4	SED 5	SED 9	SED 10	SED 11
Samples collected October 11, 2012	480-26534-3	480-26534-4	480-26534-5	480-26534-1	480-26534-6	480-26534-7	480-26534-8	480-26534-9	480-26534-10
Sample Depth (in.)	0-6	0-6	0-6	0-6	0-6	0-6	0-6	0-6	0-6
PCB-1248 (mg/Kg)	ND	2.6	0.5	1.0	0.38	0.37	ND	ND	ND
Qualifier			J		J	J			

ND=Constituent analyzed but not detected above MDL

J=Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value

Table 4A. Average Wet Weight PCB Concentration by Species

Location	CCHUB	PKSD/BLG	BT/ST*	BDACE
HHC 1	0.414	0.377	NA	NA
HHC 2	0.224	NA	NA	0.532
HHC 3	0.131	0.432	NA	0.388
HHC 4	0.129	NA	NA	0.443
HHC 5	0.192	NA	NA	0.496
HHC 6	0.281	NA	0.493	NA
TC 1	0.005	0.013	0.039	NA
TC 2	0.118	NA	0.118	NA

Table 4B. Average Lipid Based PCB Concentration by Species

Location	CCHUB	PKSD/BLG	BT/ST*	BDACE
HHC 1	37.7	30.3	NA	NA
HHC 2	19.7	NA	NA	20.6
HHC 3	9.0	20.1	NA	15.4
HHC 4	12.5	NA	NA	15.7
HHC 5	15.1	NA	NA	18.7
HHC 6	20.6	NA	42.9	NA
TC 1	0.5	0.6	2.6	NA
TC 2	5.2	NA	16.5	NA

Notes:

All values reported as mg/kg.

CCHUB=Creek Chub; PKSD=Pumpkinseed; BLG=Bluegill; BT=Brown Trout; ST=Brook Trout; BDACE=Blacknose Dace

NA = Species was not analyzed at this location

* Brown and brook trout average concentrations may include standard fillet, modified fillet, and whole body sample

Table 5A - Creek Chub Tissue Summary

Parameter	Frequency of Detection	HHC 1 - 0897637 CCHUB W 10/11/2012	HHC 1 - 0897638 CCHUB W 10/11/2012	HHC 1 - 1201 CCHUB W 10/11/2012	HHC 1 - 1202 CCHUB W 10/11/2012	HHC 1 - 1203 CCHUB W 10/11/2012	Arithmetic Mean
Mercury (Hg)	5 of 5	0.106	0.092	0.051	0.081	0.016	0.069
Aroclor 1242	5 of 5	0.044	0.165	0.130	0.282	0.067	0.138
Aroclor 1254/60	5 of 5	0.277	0.162	0.083	0.334	0.131	0.197
TPCB	5 of 5	0.716	0.327	0.213	0.616	0.198	0.414
Lipid (%)	5 of 5	1.21	1.23	0.72	1.37	0.71	1.05
Lipid PCB	5 of 5	59.174	26.585	29.597	44.964	27.944	37.653

Notes:

All values reported as mg/kg unless otherwise noted.

"-" indicates the value is a detection limit and that the contaminant was not detected. Negative values were not used in any calculations.

"U" indicates PCBs were analyzed but not detected.

Column headings include: location/field sample ID, species and preparation method, and date of collection.

BDACE=Blacknose Dace; BLG=Bluegill; BT=Brown Trout; CCHUB=Creek Chub; PKSD=Pumpkinseed; ST=Brook Trout

SF=standard fillet, W=whole fish; W-HV=whole fish minus the head and viscera

Table 5A - Creek Chub Tissue Summary

Parameter	Frequency of Detection	HHC 2 - 0897639 CCHUB W 10/12/2012	HHC 2 - 0897640 CCHUB W 10/12/2012	HHC 2 - 1201 CCHUB W 10/12/2012	HHC 2 - 1202 CCHUB WC 10/12/2012	HHC 2 - 1203 CCHUB WC 10/12/2012	Arithmetic Mean
Mercury (Hg)	5 of 5	0.207	0.225	0.191	0.134	0.115	0.174
Aroclor 1242	5 of 5	0.135	0.078	0.086	0.095	0.232	0.125
Aroclor 1254/60	5 of 5	0.100	0.129	0.061	0.092	0.113	0.099
TPCB	5 of 5	0.235	0.207	0.147	0.187	0.345	0.224
Lipid (%)	5 of 5	1.03	1.06	0.86	1.03	1.63	1.12
Lipid PCB	5 of 5	22.806	19.528	17.058	18.146	21.166	19.741

Notes:

All values reported as mg/kg unless otherwise noted.

"-" indicates the value is a detection limit and that the contaminant was not detected. Negative values were not used in any calculations.

"U" indicates PCBs were analyzed but not detected.

Column headings include: location/field sample ID, species and preparation method, and date of collection.

BDACE=Blacknose Dace; BLG=Bluegill; BT=Brown Trout; CCHUB=Creek Chub; PKSD=Pumpkinseed; ST=Brook Trout

SF=standard fillet, W=whole fish; W-HV=whole fish minus the head and viscera

Table 5A - Creek Chub Tissue Summary

Parameter	Frequency of Detection	HHC 3 - 0897641 CCHUB W 10/12/2012	HHC 3 - 0897642 CCHUB W 10/12/2012	HHC 3 - 1201 CCHUB WC 10/12/2012	HHC 3 - 1202 CCHUB WC 10/12/2012	HHC 3 - 1203 CCHUB WC 10/12/2012	Arithmetic Mean
Mercury (Hg)	5 of 5	0.140	0.123	0.081	0.103	0.113	0.112
Aroclor 1242	5 of 5	0.033	0.042	0.082	0.030	0.051	0.048
Aroclor 1254/60	5 of 5	0.091	0.068	0.100	0.080	0.077	0.083
TPCB (mg/kg)	5 of 5	0.124	0.110	0.182	0.110	0.129	0.131
Lipid (%)	5 of 5	1.02	1.57	2.12	1.36	1.38	1.49
Lipid PCB (mg/kg)	5 of 5	12.176	7.025	8.561	8.088	9.312	9.033

Notes:

All values reported as mg/kg unless otherwise noted.

"-" indicates the value is a detection limit and that the contaminant was not detected. Negative values were not used in any calculations.

"U" indicates PCBs were analyzed but not detected.

Column headings include: location/field sample ID, species and preparation method, and date of collection.

BDACE=Blacknose Dace; BLG=Bluegill; BT=Brown Trout; CCHUB=Creek Chub; PKSD=Pumpkinseed; ST=Brook Trout

SF=standard fillet, W=whole fish; W-HV=whole fish minus the head and viscera

Table 5A - Creek Chub Tissue Summary

Parameter	Frequency of Detection	HHC 4 - 0897627 CCHUB W 10/11/2012	HHC 4 - 0897628 CCHUB W 10/11/2012	HHC 4 - 0897629 CCHUB W 10/11/2012	HHC 4 - 0897630 CCHUB W 10/11/2012	HHC 4 - 0897631 CCHUB W 10/11/2012	Arithmetic Mean
Mercury (Hg)	5 of 5	0.102	0.232	0.185	0.179	0.150	0.170
Aroclor 1242	5 of 5	0.028	0.048	0.016	0.018	0.062	0.034
Aroclor 1254/60	5 of 5	0.110	0.116	0.048	0.075	0.128	0.095
TPCB (mg/kg)	5 of 5	0.138	0.164	0.064	0.092	0.190	0.129
Lipid (%)	5 of 5	0.84	1.04	0.76	1.07	1.44	1.03
Lipid PCB (mg/kg)	5 of 5	16.405	15.769	8.355	8.626	13.160	12.463

Notes:

All values reported as mg/kg unless otherwise noted.

"-" indicates the value is a detection limit and that the contaminant was not detected. Negative values were not used in any calculations.

"U" indicates PCBs were analyzed but not detected.

Column headings include: location/field sample ID, species and preparation method, and date of collection.

BDACE=Blacknose Dace; BLG=Bluegill; BT=Brown Trout; CCHUB=Creek Chub; PKSD=Pumpkinseed; ST=Brook Trout

SF=standard fillet, W=whole fish; W-HV=whole fish minus the head and viscera

Table 5A - Creek Chub Tissue Summary

Parameter	Frequency of Detection	HHC 5 - 0897625 CCHUB W 10/11/2012	HHC 5 - 0897626 CCHUB W 10/11/2012	HHC5 - 1201 CCHUB W 10/11/2012	HHC 5 - 1202 CCHUB W 10/11/2012	HHC 5 - 1203 CCHUB W 10/11/2012	Arithmetic Mean
Mercury (Hg)	5 of 5	0.174	0.181	0.203	0.228	0.059	0.169
Aroclor 1242	5 of 5	0.030	0.041	0.027	0.113	0.104	0.063
Aroclor 1254/60	5 of 5	0.110	0.115	0.081	0.271	0.068	0.129
TPCB (mg/kg)	5 of 5	0.140	0.156	0.108	0.384	0.172	0.192
Lipid (%)	5 of 5	0.91	1.15	0.81	1.39	3.12	1.48
Lipid PCB (mg/kg)	5 of 5	15.374	13.530	13.358	27.626	5.510	15.080

Notes:

All values reported as mg/kg unless otherwise noted.

"-" indicates the value is a detection limit and that the contaminant was not detected. Negative values were not used in any calculations.

"U" indicates PCBs were analyzed but not detected.

Column headings include: location/field sample ID, species and preparation method, and date of collection.

BDACE=Blacknose Dace; BLG=Bluegill; BT=Brown Trout; CCHUB=Creek Chub; PKSD=Pumpkinseed; ST=Brook Trout

SF=standard fillet, W=whole fish; W-HV=whole fish minus the head and viscera

Table 5A - Creek Chub Tissue Summary

Parameter	Frequency of Detection	HHC 6 - 0897618 CCHUB W 10/10/2012	HHC 6 - 0897619 CCHUB W 10/10/2012	HHC 6 - 1201 CCHUB W 10/10/2012	HHC 6 - 1202 CCHUB W 10/10/2012	HHC 6 - 1203 CCHUB W 10/10/2012	Arithmetic Mean
Mercury (Hg)	5 of 5	0.066	0.081	0.094	0.045	0.061	0.069
Aroclor 1242	5 of 5	0.077	0.014	0.074	0.113	0.095	0.075
Aroclor 1254/60	5 of 5	0.258	0.072	0.243	0.211	0.247	0.206
TPCB (mg/kg)	5 of 5	0.335	0.086	0.317	0.324	0.342	0.281
Lipid (%)	5 of 5	0.99	0.75	1.06	2.72	2.15	1.53
Lipid PCB (mg/kg)	5 of 5	33.808	11.520	29.896	11.912	15.912	20.610

Notes:

All values reported as mg/kg unless otherwise noted.

"-" indicates the value is a detection limit and that the contaminant was not detected. Negative values were not used in any calculations.

"U" indicates PCBs were analyzed but not detected.

Column headings include: location/field sample ID, species and preparation method, and date of collection.

BDACE=Blacknose Dace; BLG=Bluegill; BT=Brown Trout; CCHUB=Creek Chub; PKSD=Pumpkinseed; ST=Brook Trout

SF=standard fillet, W=whole fish; W-HV=whole fish minus the head and viscera

Table 5A - Creek Chub Tissue Summary

Parameter	Frequency of Detection	TC 1 - 0897606 CCHUB W 10/10/2012	TC 1 - 0897607 CCHUB W 10/10/2012	TC 1 - 0897608 CCHUB W 10/10/2012	TC 1 - 1201 CCHUB W 10/10/2012	TC 1 - 1202 CCHUB W 10/10/2012	Arithmetic Mean
Mercury (Hg)	5 of 5	0.046	0.103	0.095	0.073	0.062	0.076
Aroclor 1242	2 of 5	-0.010	-0.010	-0.010	0.011	0.011	<0.011
Aroclor 1254/60	0 of 5	-0.030	-0.030	-0.030	-0.030	-0.030	U
TPCB (mg/kg)	2 of 5	U	U	U	0.011	0.011	<0.011
Lipid (%)	5 of 5	1.19	2.03	1.41	2.03	2.42	1.82
Lipid PCB (mg/kg)	5 of 5	U	U	U	0.557	0.467	<0.557

Notes:

All values reported as mg/kg unless otherwise noted.

"-" indicates the value is a detection limit and that the contaminant was not detected. Negative values were not used in any calculations.

"U" indicates PCBs were analyzed but not detected.

Column headings include: location/field sample ID, species and preparation method, and date of collection.

BDACE=Blacknose Dace; BLG=Bluegill; BT=Brown Trout; CCHUB=Creek Chub; PKSD=Pumpkinseed; ST=Brook Trout

SF=standard fillet, W=whole fish; W-HV=whole fish minus the head and viscera

Table 5A - Creek Chub Tissue Summary

Parameter	Frequency of Detection	TC 2 - 0897615 CCHUB W 10/10/2012	TC 2 - 0897616 CCHUB W 10/10/2012	TC 2 - 0897617 CCHUB W 10/10/2012	TC 2 - 1201 CCHUB WC 10/10/2012	TC 2 - 1202 CCHUB WC 10/10/2012	Arithmetic Mean
Mercury (Hg)	5 of 5	0.073	0.073	0.204	0.083	0.047	0.096
Aroclor 1242	3 of 5	-0.010	-0.010	0.040	0.055	0.037	<0.055
Aroclor 1254/60	5 of 5	0.032	0.037	0.143	0.145	0.103	0.092
TPCB (mg/kg)	5 of 5	0.032	0.037	0.183	0.200	0.140	0.118
Lipid (%)	5 of 5	0.72	0.93	2.40	3.72	2.96	2.15
Lipid PCB (mg/kg)	5 of 5	4.403	4.011	7.642	5.374	4.723	5.230

Notes:

All values reported as mg/kg unless otherwise noted.

"-" indicates the value is a detection limit and that the contaminant was not detected. Negative values were not used in any calculations.

"U" indicates PCBs were analyzed but not detected.

Column headings include: location/field sample ID, species and preparation method, and date of collection.

BDACE=Blacknose Dace; BLG=Bluegill; BT=Brown Trout; CCHUB=Creek Chub; PKSD=Pumpkinseed; ST=Brook Trout

SF=standard fillet, W=whole fish; W-HV=whole fish minus the head and viscera

Table 5B - Pumpkinseed & Bluegill Tissue Summary

Parameter	Frequency of Detection	HHC 1 - 0897632 PKSD W 10/11/2012	HHC 1 - 0897633 PKSD W 10/11/2012	HHC 1 - 0897634 PKSD W 10/11/2012	HHC 1 - 0897635 PKSD W 10/11/2012	HHC 1 - 0897636 PKSD W 10/11/2012	Arithmetic Mean
Mercury (Hg)	5 of 5	0.136	0.097	0.164	0.156	0.149	0.140
Aroclor 1242	5 of 5	0.118	0.312	0.068	0.103	0.444	0.209
Aroclor 1254/60	5 of 5	0.166	0.192	0.111	0.097	0.272	0.168
TPCB (mg/kg)	5 of 5	0.284	0.504	0.179	0.200	0.716	0.377
Lipid %	5 of 5	0.85	1.54	1.09	1.06	1.68	1.24
Lipid PCB (mg/kg)	5 of 5	33.412	32.727	16.431	18.849	42.619	28.808

Notes:

All values reported as mg/kg unless otherwise noted.

"-" indicates the value is a detection limit and that the contaminant was not detected. Negative values were not used in any calculations.

"U" indicates PCBs were analyzed but not detected.

Column headings include: location/field sample ID, species and preparation method, and date of collection.

BDACE=Blacknose Dace; BLG=Bluegill; BT=Brown Trout; CCHUB=Creek Chub; PKSD=Pumpkinseed; ST=Brook Trout

SF=standard fillet, W=whole fish; W-HV=whole fish minus the head and viscera

Table 5B - Pumpkinseed & Bluegill Tissue Summary

Parameter	Frequency of Detection	HHC 3 - 1206 PKSD W 10/12/2012	HHC 3 - 1207 PKSD W 10/12/2012	Arithmetic Mean		TC 1 - 1204 BLG W 10/10/2012
Mercury (Hg)	2 of 2	0.155	0.090	0.122		0.129
Aroclor 1242	2 of 2	0.110	0.322	0.216		0.013
Aroclor 1254/60	2 of 2	0.185	0.247	0.216		-0.030
TPCB (mg/kg)	2 of 2	0.295	0.569	0.432		0.013
Lipid %	2 of 2	1.45	2.84	2.15		2.21
Lipid PCB (mg/kg)	2 of 2	20.345	20.035	20.190		0.602

Notes:

All values reported as mg/kg unless otherwise noted.

"-" indicates the value is a detection limit and that the contaminant was not detected. Negative values were not used in any calculations.

"U" indicates PCBs were analyzed but not detected.

Column headings include: location/field sample ID, species and preparation method, and date of collection.

BDACE=Blacknose Dace; BLG=Bluegill; BT=Brown Trout; CCHUB=Creek Chub; PKSD=Pumpkinseed; ST=Brook Trout

SF=standard fillet, W=whole fish; W-HV=whole fish minus the head and viscera

Table 5C - Brook Trout & Brown Trout Tissue Summary

Parameter	Frequency of Detection	HHC 6 - 897620 ST W-HV 10/10/2012	HHC 6 - 897621 ST W-HV 10/10/2012	HHC 6 - 897622 ST W 10/10/2012	HHC 6 - 897623 ST W 10/10/2012	HHC 6 - 897624 ST W 10/10/2012	Arithmetic Mean
Mercury (Hg)	5 of 5	0.067	0.106	0.093	0.056	0.109	0.086
Aroclor 1242	5 of 5	0.240	0.179	0.189	0.199	0.135	0.188
Aroclor 1254/60	5 of 5	0.372	0.294	0.326	0.286	0.246	0.305
TPCB (mg/kg)	5 of 5	0.612	0.473	0.515	0.485	0.381	0.493
Lipid %	5 of 5	1.28	1.14	0.76	1.26	1.31	1.15
Lipid PCB (mg/kg)	5 of 5	47.813	41.491	67.763	38.492	29.084	44.929

Notes:

All values reported as mg/kg unless otherwise noted.

"-" indicates the value is a detection limit and that the contaminant was not detected. Negative values were not used in any calculations.

"U" indicates PCBs were analyzed but not detected.

Column headings include: location/field sample ID, species and preparation method, and date of collection.

BDACE=Blacknose Dace; BLG=Bluegill; BT=Brown Trout; CCHUB=Creek Chub; PKSD=Pumpkinseed; ST=Brook Trout

SF=standard fillet, W=whole fish; W-HV=whole fish minus the head and viscera

Table 5C - Brook Trout & Brown Trout Tissue Summary

Parameter	Frequency of Detection	TC 1 - 897601 BT SF 10/10/2012	TC 1 - 897602 BT SF 10/10/2012	TC 1 - 897603 BT SF 10/10/2012	TC 1 - 897604 ST W 10/10/2012	TC 1 - 897605 ST W 10/10/2012	TC 1 - 1203 ST W 10/10/2012	Arithmetic Mean
Mercury (Hg)	6 of 6	0.18	0.0622	0.064	0.082	0.0753	0.0537	0.0862
Aroclor 1242	2 of 6	0.0571	-0.01	-0.01	-0.01	-0.01	0.0131	<0.0571
Aroclor 1254/60	2 of 6	0.128	-0.03	-0.03	-0.03	0.036	-0.03	<0.128
TPCB (mg/kg)	3 of 6	0.1851	U	U	U	0.036	0.0131	<0.078
Lipid %	6 of 6	1.43	1.08	1.49	0.79	1.73	1.9	1.40
Lipid PCB (mg/kg)	3 of 6	12.944	U	U	U	2.081	0.689	<5.283

Notes:

All values reported as mg/kg unless otherwise noted.

"-" indicates the value is a detection limit and that the contaminant was not detected. Negative values were not used in any calculations.

"U" indicates PCBs were analyzed but not detected.

Column headings include: location/field sample ID, species and preparation method, and date of collection.

BDACE=Blacknose Dace; BLG=Bluegill; BT=Brown Trout; CCHUB=Creek Chub; PKSD=Pumpkinseed; ST=Brook Trout

SF=standard fillet, W=whole fish; W-HV=whole fish minus the head and viscera

Table 5C - Brook Trout & Brown Trout Tissue Summary

Parameter	Frequency of Detection	TC 2 - 897609 BT W-HV 10/10/2012	TC 2 - 897610 BT W-HV 10/10/2012	TC 2 - 897611 BT W 10/10/2012	TC 2 - 897612 BT W 10/10/2012	TC 2 - 897613 BT W 10/10/2012	TC 2 - 897614 ST W 10/10/2012	Arithmetic Mean
Mercury (Hg)	6 of 6	0.125	0.0703	0.0796	0.0901	0.0827	0.0706	0.0864
Aroclor 1242	4 of 6	-0.01	-0.01	0.0202	0.0117	0.0126	0.0389	<0.0389
Aroclor 1254/60	6 of 6	0.09	0.0695	0.118	0.0987	0.107	0.14	0.1039
TPCB (mg/kg)	6 of 6	0.09	0.0695	0.1382	0.1104	0.1196	0.1789	0.1178
Lipid %	6 of 6	0.52	0.58	0.85	0.5	0.64	1.42	0.75
Lipid PCB (mg/kg)	6 of 6	17.308	11.983	16.259	22.080	18.688	12.599	16.486

Notes:

All values reported as mg/kg unless otherwise noted.

"-" indicates the value is a detection limit and that the contaminant was not detected. Negative values were not used in any calculations.

"U" indicates PCBs were analyzed but not detected.

Column headings include: location/field sample ID, species and preparation method, and date of collection.

BDACE=Blacknose Dace; BLG=Bluegill; BT=Brown Trout; CCHUB=Creek Chub; PKSD=Pumpkinseed; ST=Brook Trout

SF=standard fillet, W=whole fish; W-HV=whole fish minus the head and viscera

Table 5D - Blacknose Dace Tissue Summary

Parameter	Frequency of Detection	HHC 2 - 1204 BDACE WC 10/12/2012	HHC 2 - 1205 BDACE WC 10/12/2012	Arithmetic Mean		Frequency of Detection	HHC 3 - 1204 BDACE WC 10/12/2012	HHC 3 - 1205 BDACE WC 10/12/2012	Arithmetic Mean
Mercury (Hg)	2 of 2	0.296	0.17	0.233		2 of 2	0.177	0.121	0.149
Aroclor 1242	2 of 2	0.319	0.244	0.2815		2 of 2	0.278	0.0921	0.18505
Aroclor 1254/60	2 of 2	0.297	0.204	0.2505		2 of 2	0.271	0.135	0.203
TPCB (mg/kg)	2 of 2	0.616	0.448	0.532		2 of 2	0.549	0.2271	0.38805
Lipid %	2 of 2	2.72	2.45	2.585		2 of 2	2.5	2.55	2.525
Lipid PCB (mg/kg)	2 of 2	22.647	18.286	20.466		2 of 2	21.960	8.906	15.433

Notes:

All values reported as mg/kg unless otherwise noted.

"-" indicates the value is a detection limit and that the contaminant was not detected. Negative values were not used in any calculations.

"U" indicates PCBs were analyzed but not detected.

Column headings include: location/field sample ID, species and preparation method, and date of collection.

BDACE=Blacknose Dace; BLG=Bluegill; BT=Brown Trout; CCHUB=Creek Chub; PKSD=Pumpkinseed; ST=Brook Trout

SF=standard fillet, W=whole fish; W-HV=whole fish minus the head and viscera

Table 5D - Blacknose Dace Tissue Summary

Parameter	Frequency of Detection	HHC 4 - 1201 BDACE WC 10/11/2012	HHC 4 - 1202 BDACE WC 10/11/2012	HHC 4 - 1203 BDACE WC 10/11/2012	HHC 4 - 1204 BDACE WC 10/11/2012	HHC 4 - 1205 BDACE WC 10/11/2012	Arithmetic Mean
Mercury (Hg)	5 of 5	0.262	0.272	0.245	0.331	0.161	0.254
Aroclor 1242	5 of 5	0.155	0.207	0.144	0.154	0.153	0.163
Aroclor 1254/60	5 of 5	0.270	0.282	0.311	0.316	0.223	0.280
TPCB (mg/kg)	5 of 5	0.425	0.489	0.455	0.470	0.376	0.443
Lipid %	5 of 5	3.11	2.96	2.77	2.43	2.82	2.82
Lipid PCB (mg/kg)	5 of 5	13.666	16.520	16.426	19.342	13.333	15.857

Notes:

All values reported as mg/kg unless otherwise noted.

"-" indicates the value is a detection limit and that the contaminant was not detected. Negative values were not used in any calculations.

"U" indicates PCBs were analyzed but not detected.

Column headings include: location/field sample ID, species and preparation method, and date of collection.

BDACE=Blacknose Dace; BLG=Bluegill; BT=Brown Trout; CCHUB=Creek Chub; PKSD=Pumpkinseed; ST=Brook Trout

SF=standard fillet, W=whole fish; W-HV=whole fish minus the head and viscera

Table 5D - Blacknose Dace Tissue Summary

Parameter	Frequency of Detection	HHC 5 - 1204 BDACE WC 10/11/2012	HHC 5 - 1205 BDACE WC 10/11/2012	HHC 5 - 1206 BDACE WC 10/11/2012	HHC 5 - 1207 BDACE WC 10/11/2012	HHC 5 - 1208 BDACE WC 10/11/2012	Arithmetic Mean
Mercury (Hg)	5 of 5	0.229	0.253	0.339	0.195	0.206	0.244
Aroclor 1242	5 of 5	0.113	0.102	0.511	0.126	0.196	0.210
Aroclor 1254/60	5 of 5	0.258	0.325	0.260	0.251	0.337	0.286
TPCB (mg/kg)	5 of 5	0.371	0.427	0.771	0.377	0.533	0.496
Lipid %	5 of 5	2.20	1.99	3.43	2.83	2.80	2.65
Lipid PCB (mg/kg)	5 of 5	16.864	21.457	22.478	13.322	19.036	18.631

Notes:

All values reported as mg/kg unless otherwise noted.

"-" indicates the value is a detection limit and that the contaminant was not detected. Negative values were not used in any calculations.

"U" indicates PCBs were analyzed but not detected.

Column headings include: location/field sample ID, species and preparation method, and date of collection.

BDACE=Blacknose Dace; BLG=Bluegill; BT=Brown Trout; CCHUB=Creek Chub; PKSD=Pumpkinseed; ST=Brook Trout

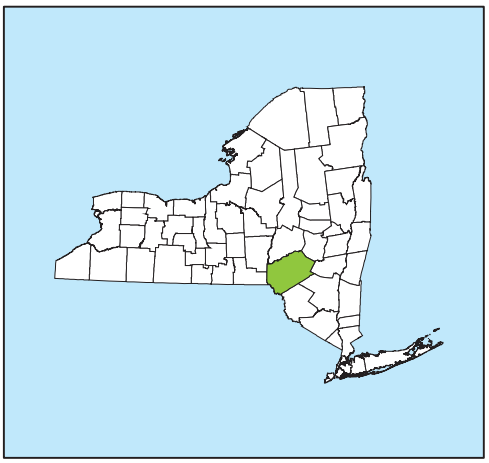
SF=standard fillet, W=whole fish; W-HV=whole fish minus the head and viscera

Richardson Hill Road Landfill

Figure 1. Site Location

0 0.5 1 2 Miles

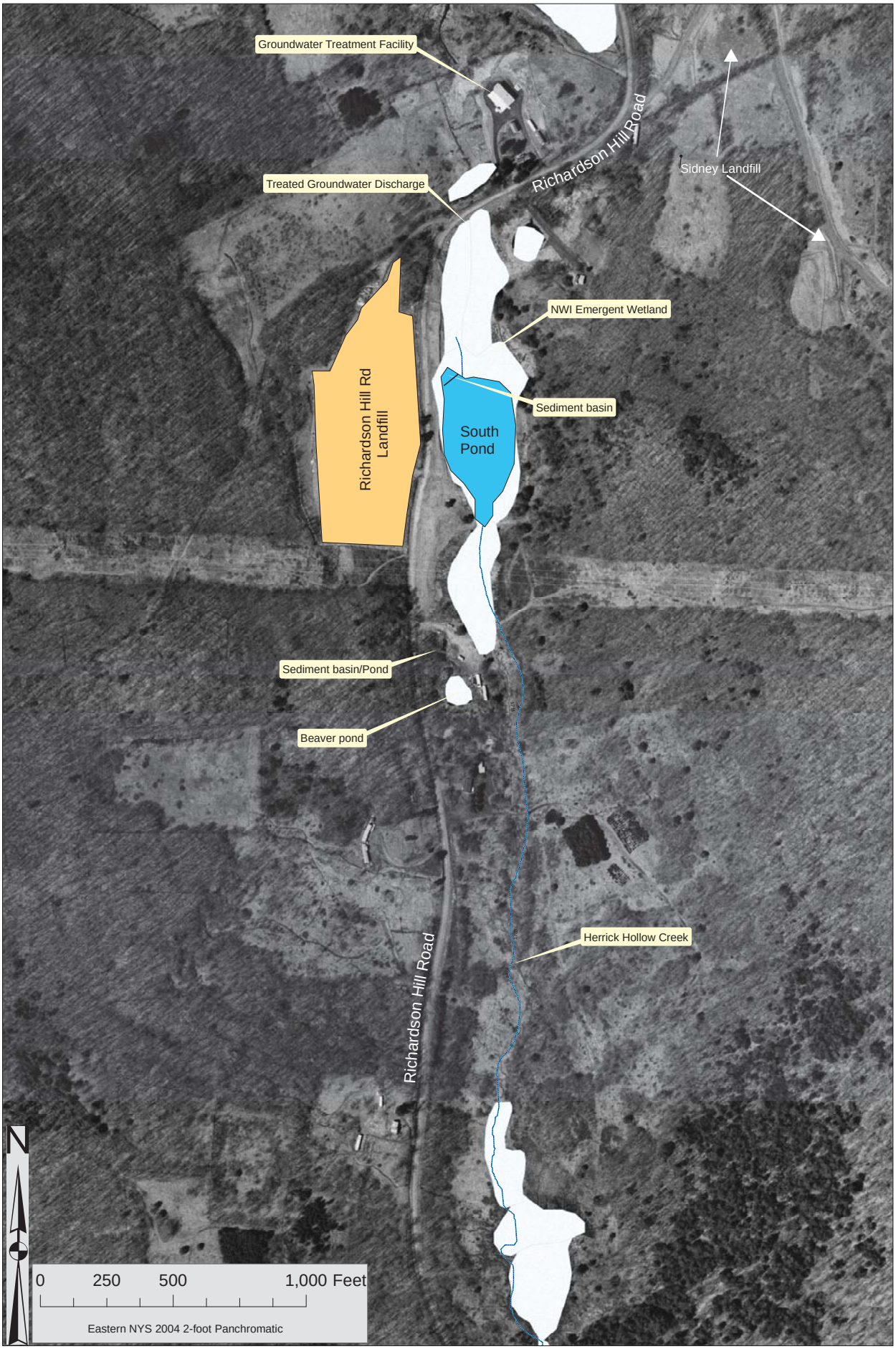
N



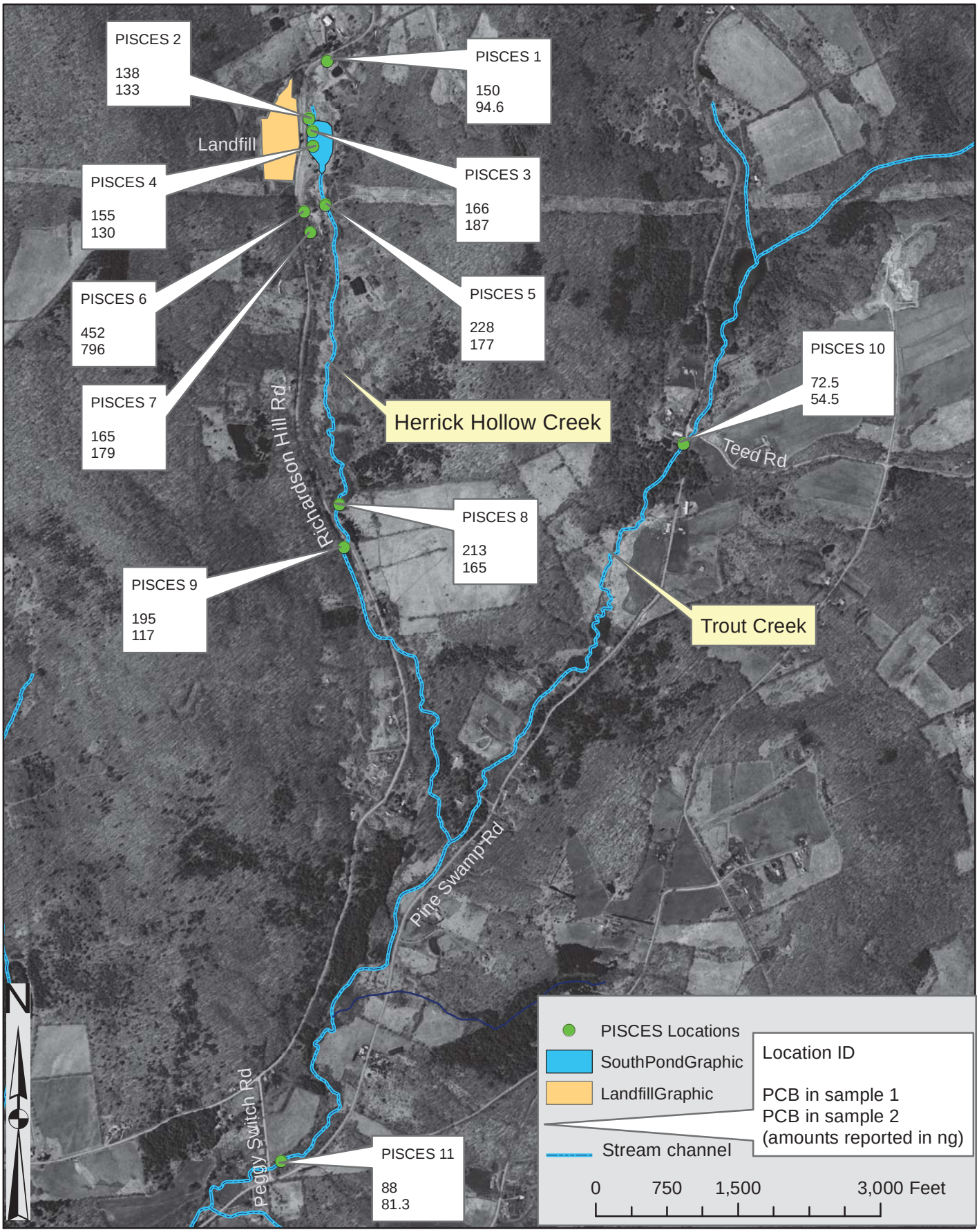
USGS 7.5 Minute Topographic Mosaic

Richardson Hill Road Landfill

Figure 2. Site Map



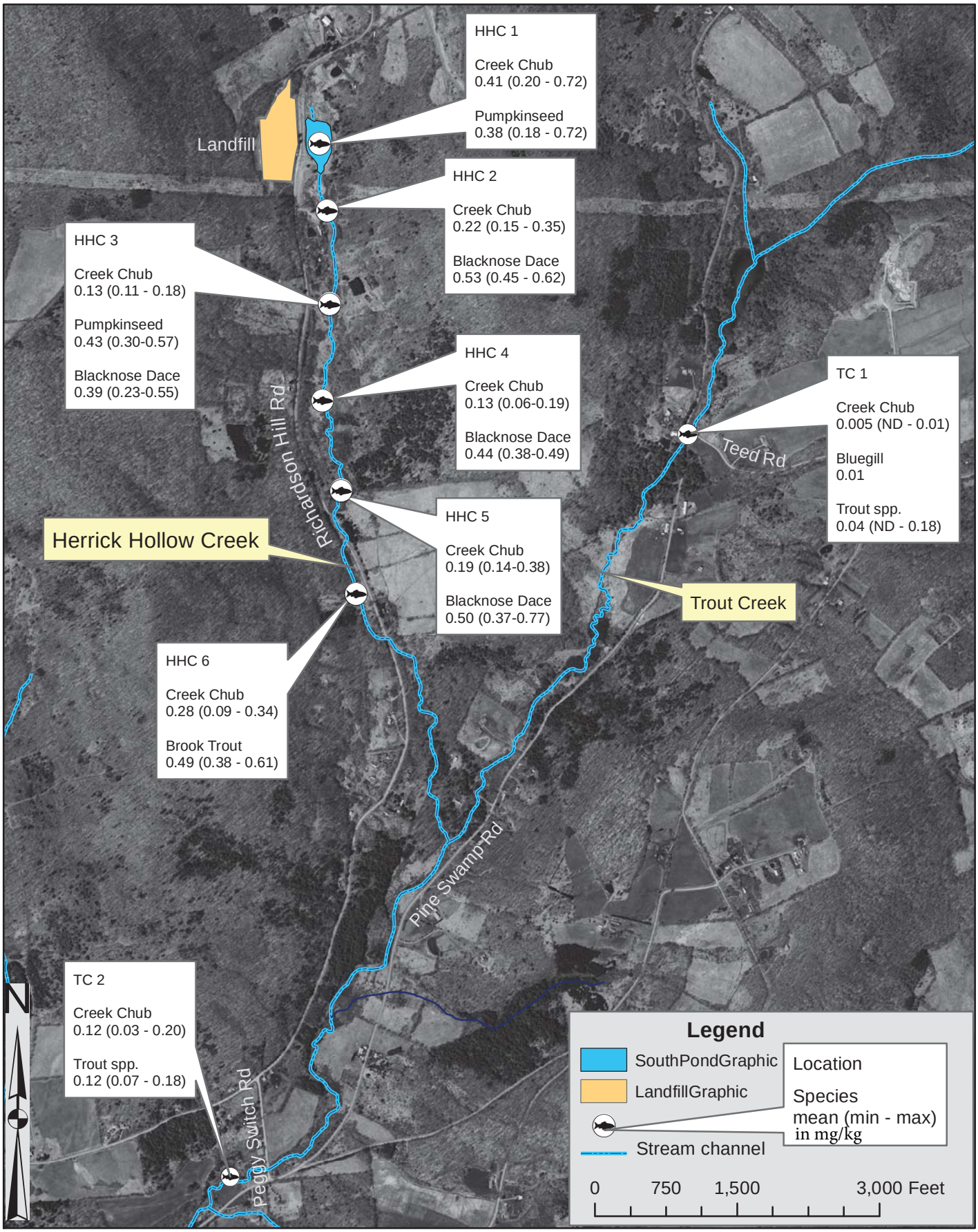
Richardson Hill Road Landfill
Figure 3. 2012 PISCES Sample Locations With Results



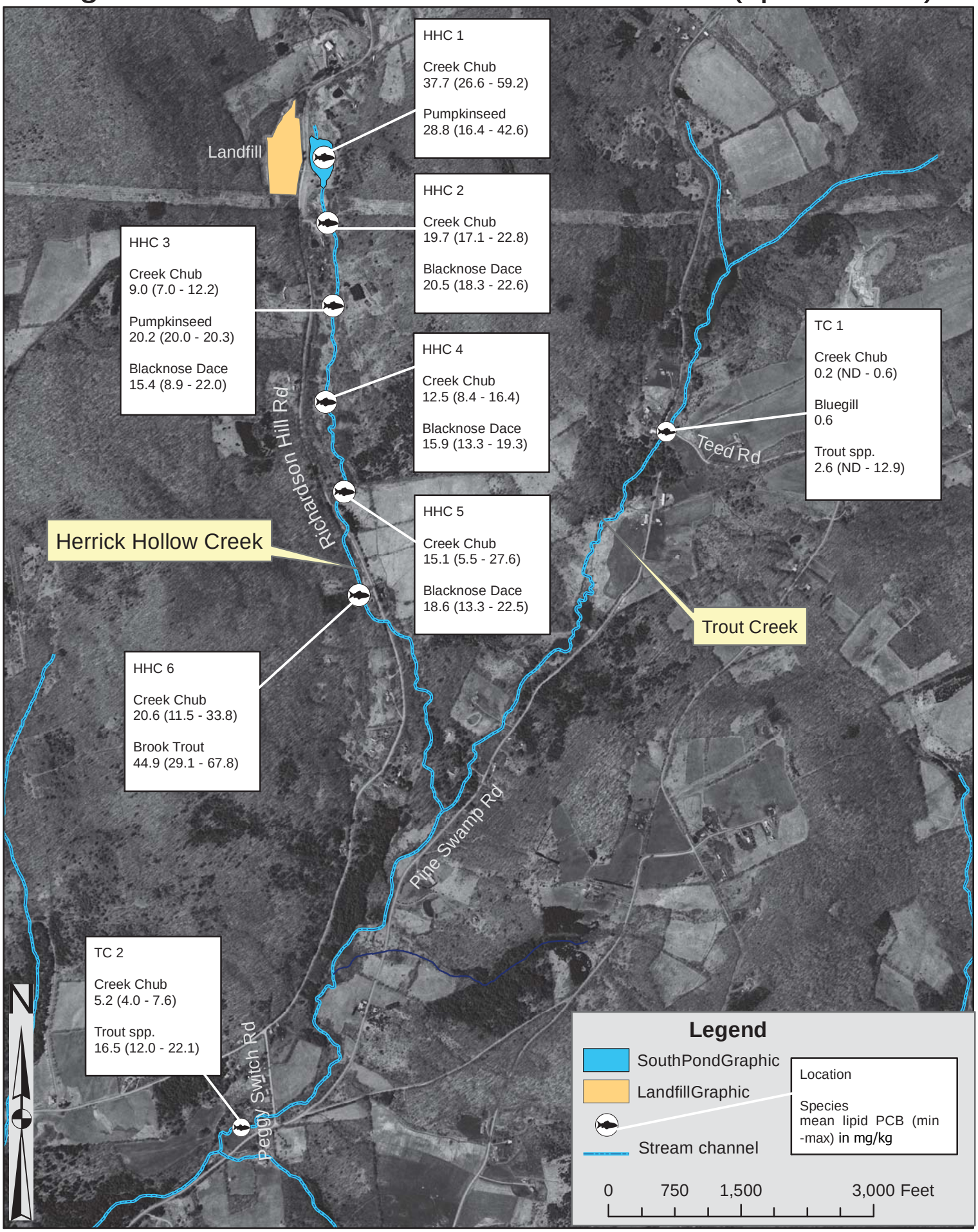
Richardson Hill Road Landfill

Figure 4. 2012 Sediment Sample Locations with PCB Results

Richardson Hill Road Landfill
Figure 5. 2012 Fish Tissue PCB Results (wet wt.)



Richardson Hill Road Landfill
Figure 6. 2012 Fish Tissue PCB Results (lipid based)



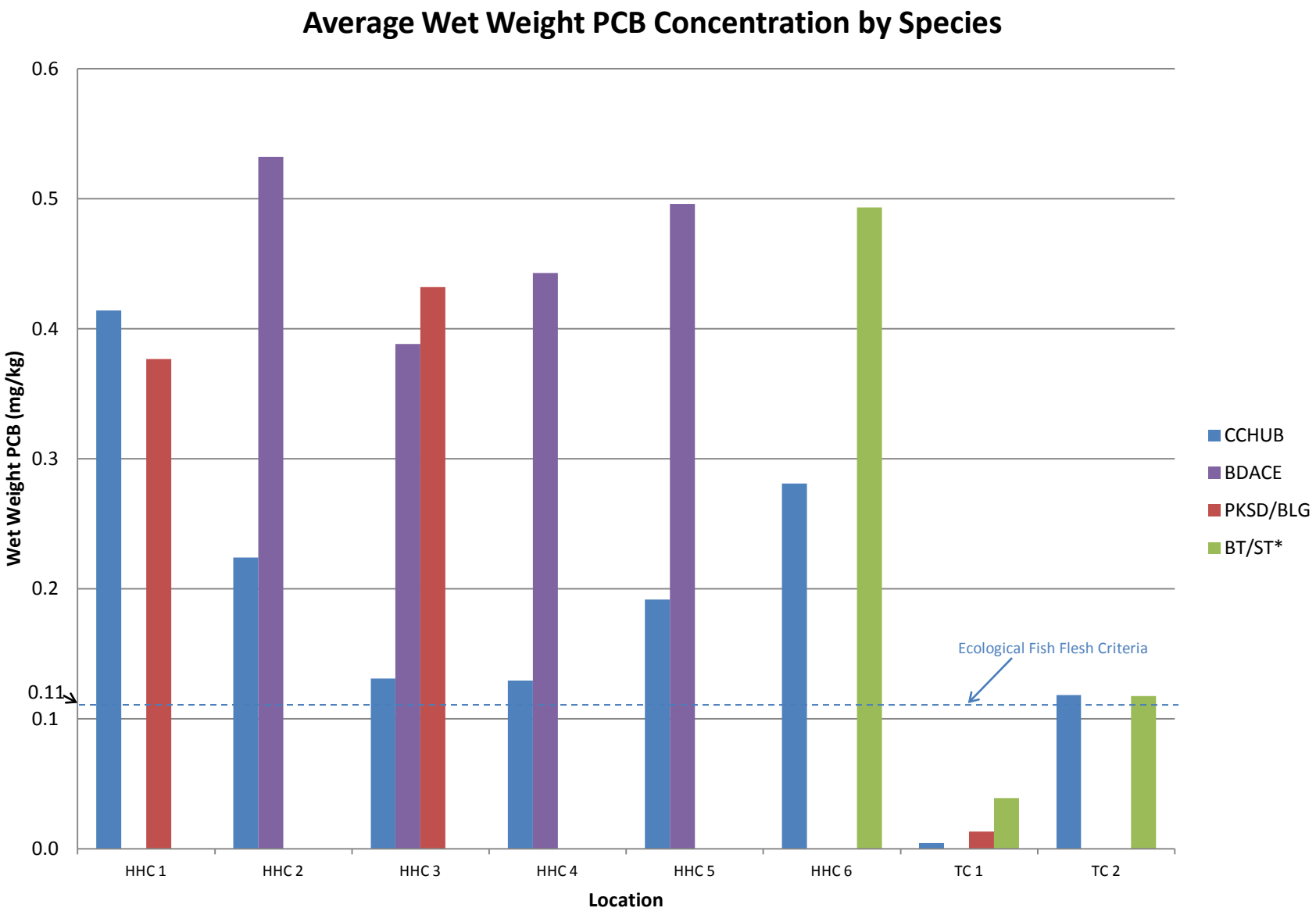


Figure 7. Comparison of average wet weight PCB concentrations among Herrick Hollow Creek and Trout Creek sample locations. Empty spaces indicate those species were not collected at a given location and do not indicate 0.0 mg/kg PCB concentrations. Creek chub (CCHUB), pumpkinseed/bluegill (PKSD/BLG) and blacknose dace (BDACE) were analyzed as whole body samples. *Brown and brook trout (BT/ST) averages include standard fillet, modified fillet, and whole body samples.

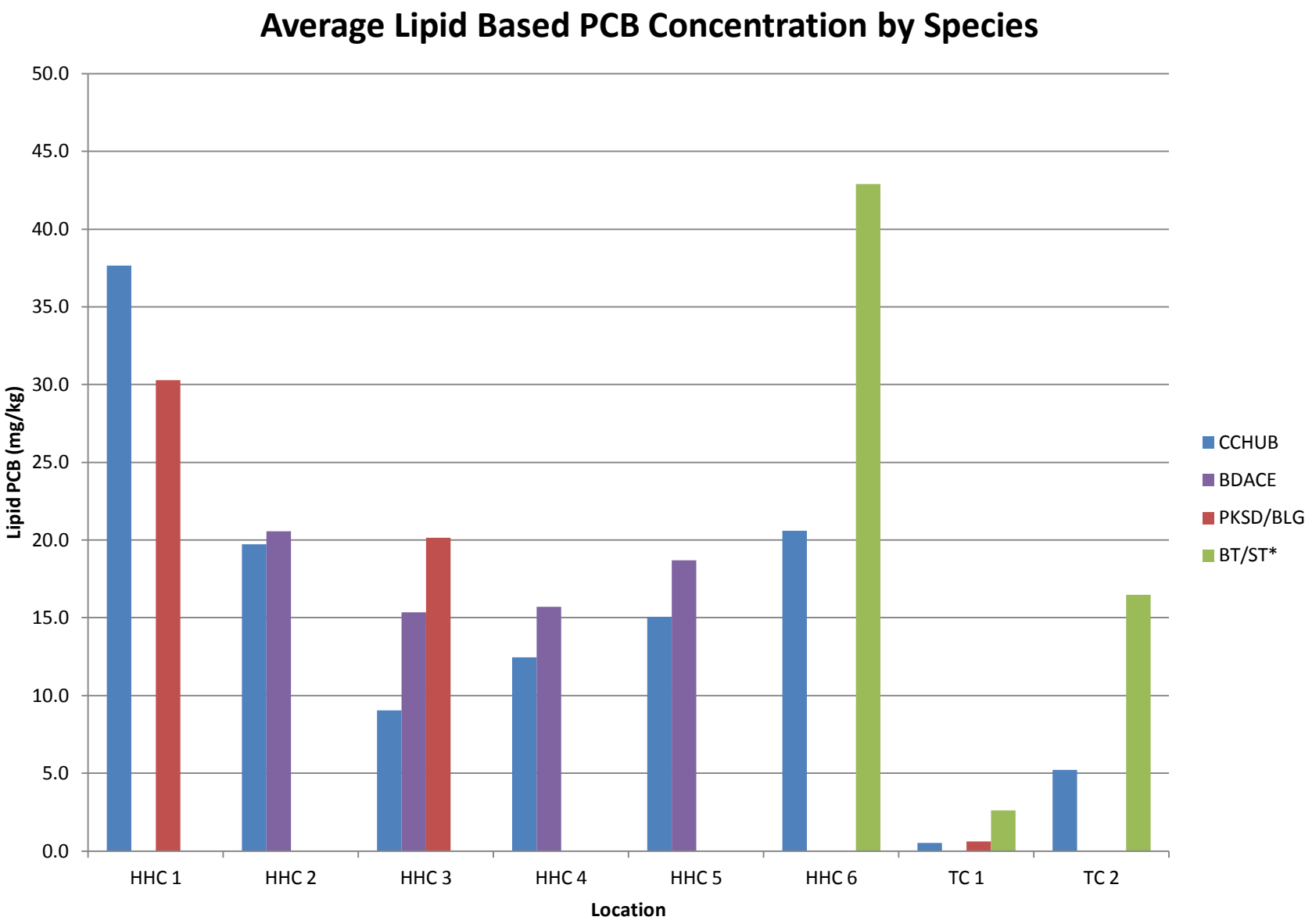


Figure 8. Comparison of lipid based PCB concentrations among Herrick Hollow Creek and Trout Creek sample locations. Empty spaces indicate those species were not collected at a given location and do not indicate 0.0 mg/kg PCB concentrations. Creek chub (CCHUB), pumpkinseed/bluegill (PKSD/BLG) and blacknose dace (BDACE) were analyzed as whole body samples. *Brown and brook trout (BT/ST) averages include standard fillet, modified fillet, and whole body samples.

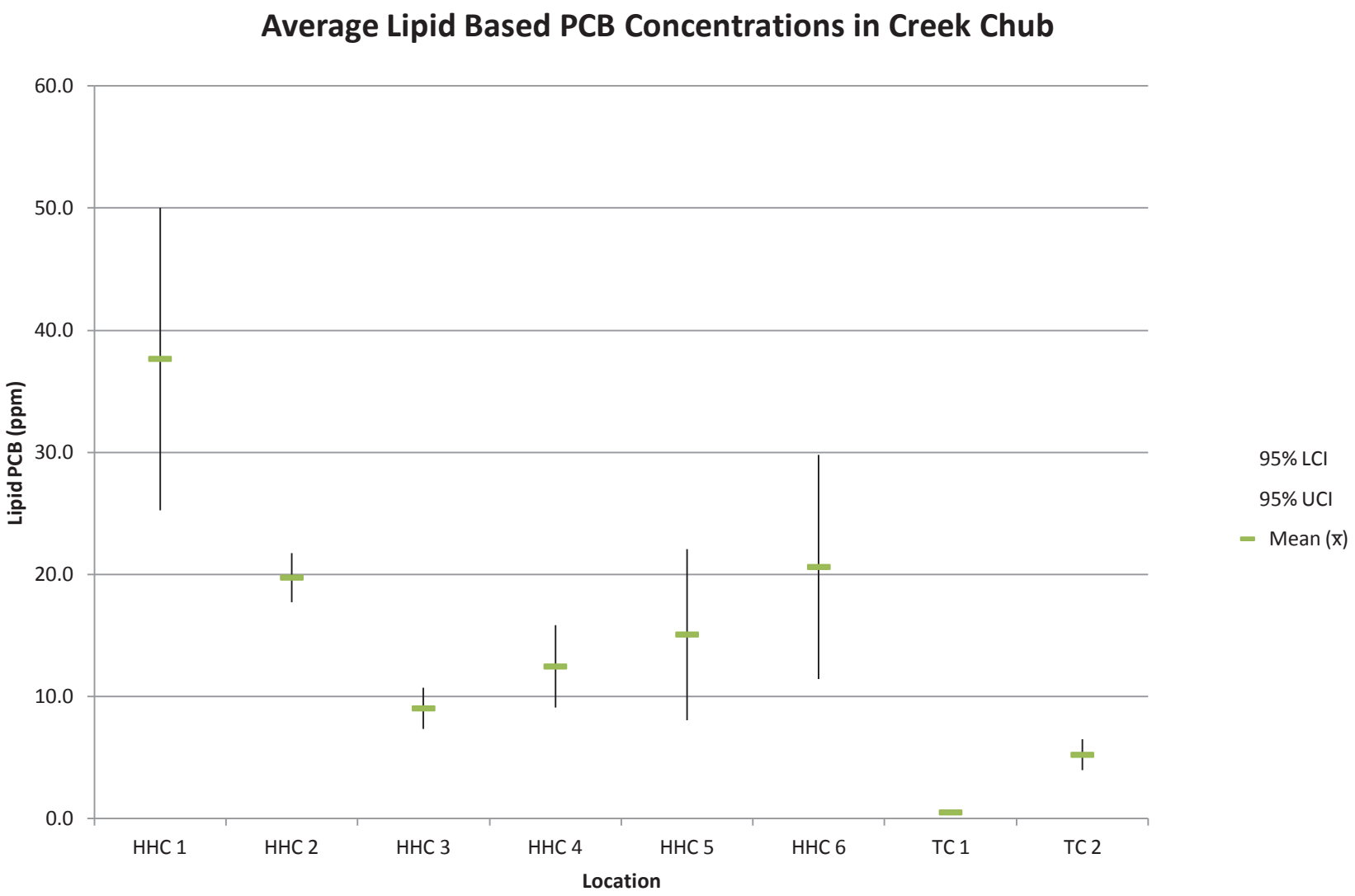


Figure 9. Comparison of average lipid based PCB concentrations in creek chub among Herrick Hollow Creek and Trout Creek sample locations.